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**COMPUTER-INTEGRATED  
KNOWLEDGE SYSTEM (CIKS)  
NETWORK: REPORT OF THE 2<sup>ND</sup>  
WORKSHOP**

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United States Department of Commerce  
Technology Administration  
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## **1. INTRODUCTION**

The 2<sup>nd</sup> workshop on the Computer-Integrated Knowledge Systems (CIKS) Network for Materials and Systems was held on September 24-25, 1997 at the Holiday Inn in Gaithersburg, Maryland. The workshop was sponsored by the National Institute of Standards and Technology (NIST), the Civil Engineering Research Foundation (CERF), Construction Materials Council (CONMAT Council) and the American Society for Testing and Materials (ASTM). The purpose of this workshop was to advance the CIKS program by seeking new input on knowledge needs from construction industry organizations, discuss and document progress occurring in the CIKS Working Groups, and critique the proposed CIKS framework. Unlike the 1<sup>st</sup> CIKS workshop, the 2<sup>nd</sup> workshop had a more narrow focus. Although the agenda provided for the opportunity for all construction industry organizations to attend, based on the participation and subject areas programmed for the keynote talks, the following topics and assumptions became the workshop focus.

- ❑ Construction materials, products, and systems
- ❑ Engineering-related activities such as diagnostics, material/product selection, and repair procedures and materials
- ❑ Public works structures (e.g., highway bridges and pavements, and hydraulic structures such as locks and dams)
- ❑ Electronic knowledge representation for terminology and nomenclature, databases, computer-based models, and decision support modules
- ❑ Knowledge interoperability (the capability of accessing and integrating knowledge among computer based knowledge systems in a seamless manner).

### **1.1 Purpose and Goals of the CIKS Network**

The initial goals for CIKS were defined by NIST during the 1<sup>st</sup> workshop. They included provisions for:

- ❑ Universal electronic access to distributed material data, information, and knowledge;
- ❑ Application systems that use the data, information, and knowledge in: (a) material design, and (b) facility design, construction or installation/application, operation, maintenance, repair and disposal;
- ❑ An open testbed for industry, university, and government partners to build and evaluate prototype systems, including enabling information technologies;
- ❑ Commercial-scale systems developed, deployed and maintained by industry.

These goals represented an ambitious undertaking and long-term vision for the program. They would require vast amounts of staff and funding resources and collaboration by construction industry organizations. Results of the first workshop and collaboration from 1996-1997 indicated that in order for CIKS to make progress in its goals, a more focused agenda would have to be adopted. Therefore, the topics and focus areas described in the Introduction became the primary agenda for CIKS activities. In addition, attempts were made to create partnerships with organizations whose goals and agendas complimented the refined CIKS program. As a result several partnerships were created that involved NIST and the following construction industry and academic organizations. These included:

- ❑ The American Concrete Institute
- ❑ The Society for Protective Coatings
- ❑ U.S. Department of Transportation, Turner-Fairbanks Research Center
- ❑ U.S. Army Corps of Engineers, Waterways Experiment Station
- ❑ University of Maryland Baltimore County

These organizations are represented by many different disciplines and include standards committees, facility owners, consultants, contractors, engineers, researchers, and information technologists. These partnerships exist today and specific projects are underway to address construction industry knowledge needs. Details of the projects are presented in the CIKS Working Group summaries, later in this report.

## **1.2 Status of CIKS and The Testbed**

Since its beginning, the CIKS program has strived to develop a meaningful focus that is practical and useful from two perspectives; 1) to demonstrate prototype systems and methodologies that can be adopted by construction industry organizations in their development of knowledge bases, and 2) to disseminate NIST research results related to high-performance construction materials and systems (HPCMS). Since the construction industry is represented by small and medium sized companies, it was important to partner with organizations that maintain leadership positions and who must deal with many constructed facilities and complex problems. This strategy is evident in the type of organizations listed in the partnerships identified in the previous section. The following activities are examples of the interactions:

- ❑ Joint CIKS Working Groups with the American Concrete Institute and the Society for Protective Coatings knowledge committees.
- ❑ Adoption of NIST-developed methodologies for engineering decision support applications for highway and hydraulic structures within the Federal Highway Administration, Turner-Fairbank Research Center and hydraulic structures with the U.S. Army Corps of Engineers, Waterways Experiment station.

- ❑ Adoption of methodologies for intragroup communication within the industrial coating industry.
- ❑ Adoption of Internet remote access methods for construction material property and product databases involving coating and concrete constituent materials.

Specific details and references for these projects are described in the CIKS Working Group summary reports. In addition, examples not originally represented in the CIKS focus are the NIST Coatings Service-Life Prediction Consortium [3] and the Partnership for Advancing Technology for Housing: Durability (PATH-D). These programs are already using many of the CIKS methodologies or are giving them consideration. The CIKS Internet database server and World Wide Web site [<http://www.ciks.nist.gov>] have been instrumental in disseminating information regarding the CIKS program.

### **1.3 Workshop Objectives**

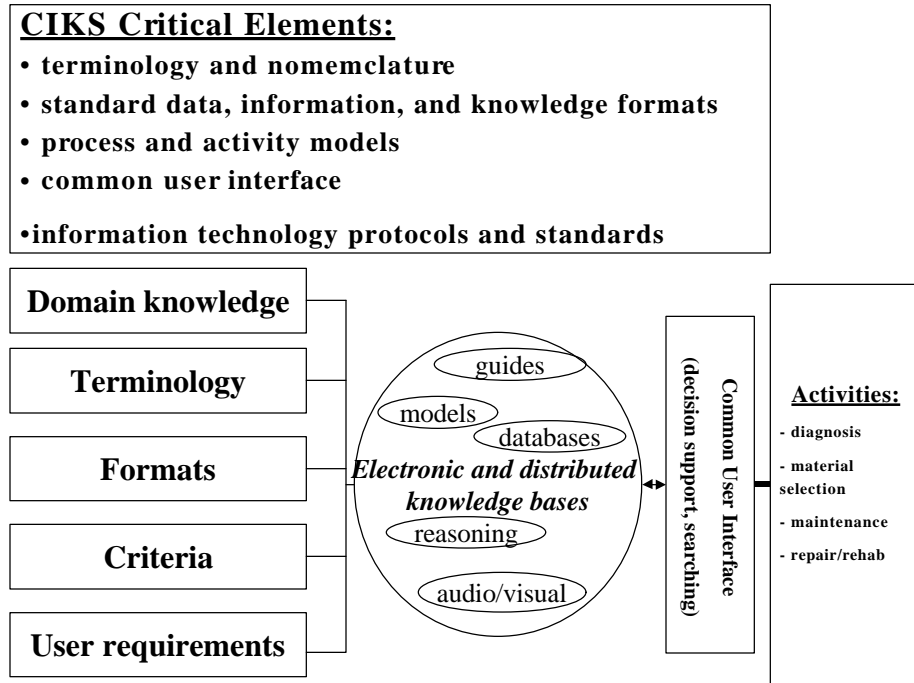
The objectives of the 2<sup>nd</sup> CIKS workshop were established so that information on several important topics and features of CIKS could be presented and discussed. The workshop was intended to foster discussion of specific on-going projects, forge new partnerships, and critique the proposed CIKS framework. The stated objectives were:

- ❑ To identify and prioritize current and future knowledge needs of the construction industry as they relate to construction materials, products, and systems.
- ❑ To critique the proposed framework for developing and implementing CIKS.
- ❑ To identify and assess opportunities for private and public partnerships for developing CIKS.

These objectives were then considered based on the interest expressed by the participants and in the context of the workshop focus areas identified in the Introduction to this report.

In an attempt to keep the workshop focused, an underlying premise and architecture was developed by NIST before the meeting. Since the ultimate goal for CIKS is to provide universal access to electronically stored and evaluated knowledge, critical elements were identified. These included terminology and nomenclature, standardized knowledge formats, and process and activity models. Addressing these areas would maximize the potential for seamless knowledge integration (interoperability) among electronically distributed knowledge bases. Figure 1 identifies the critical elements and shows the connections and examples of construction industry activities. Using this as a model, along with the use of commercial off-the-shelf information technologies, applications could then be developed and knowledge use improved.





**Figure 1: CIKS critical elements and construction industry activities.**

## 1.4 Workshop Organization

The organizational structure of the workshop is presented in Appendix A of this report. The Appendices also contain information and lists of sponsoring organizations, committees, participants and working groups. The program for the workshop began on day 1 with a welcome and introduction by the CIKS Coordinator. To set the stage for presentations and discussions and to demonstrate the need for a unified effort for knowledge activities within the construction industry, Dr. Richard Wright, Director of the NIST, Building and Fire Research Laboratory gave a presentation on “Sound Decisions in Design, Construction and Use of Constructed Facilities.”

Seven keynote presentations followed during the morning session. The keynote presentations were divided into two groups. Keynote I, “Building Blocks for Knowledge Exchange,” presented information on terminology, tools for knowledge sharing, electronic commerce for engineering application. Presentations in the Keynote II group were given by representatives from industry who discussed and demonstrated actual applications. The final keynote presentation was given on the CIKS Framework and Testbed by Thomas Kurihara of the CIKS staff.

At the completion of the keynote presentations, John Meyer, Workshop Co-chair, presented a charge to the working groups. The goals and objectives for the CIKS Working Group breakout sessions were:

- ❑ Identify knowledge user needs for materials, components, and systems.
- ❑ Critique the proposed CIKS framework for its application/benefit to materials areas.
- ❑ Identify opportunities for partnerships and funding sources.
- ❑ Develop and prioritize recommendations on pilot projects and the NIST role.

The working groups met during the afternoon of Day 1 and the morning of Day 2 to address their agenda. Groups meeting during the breakout sessions included

- ❑ Aluminum (WG1)
- ❑ Coating (WG2)
- ❑ Composites and Geosynthetics (WG3)
- ❑ Concrete and Masonry (WG4)
- ❑ Fire Safety (WG5)
- ❑ Information Technology (WG6)

Information technologists were assigned to each CIKS Working Group. They served as a resource to assist the working group members in addressing their goals and objectives and to explain information technology issues. The Information Technology Working Group also met on Day 2 to discuss their interactions and to critique the materials working group breakout sessions. Upon completion of the working group sessions on the morning of Day 2, a wrap-up session was held in which the chair of each working group presented a summary of their findings. During the afternoon of Day 2, closing remarks were presented, a discussion period was held, and tours of NIST knowledge-related facilities were conducted.

## **1.5 Report Scope and Contents**

The preceding sections on the CIKS program goals and objectives have been written to provide the reader with information the CIKS program progress up to the time of the workshop. The remainder of this report focuses on the presentations, activities and discussions, and conclusions and recommendations resulting from the workshop. The appendices serve to document the workshop agenda and participation.